

AN UNUSUAL NEW SPECIES OF *MUNDOCHTHONIUS*
FROM A CAVE IN COLORADO, WITH COMMENTS ON
MUNDOCHTHONIUS MONTANUS
(PSEUDOSCORPIONES, CHTHONIIDAE)

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ABSTRACT. *Mundochthonius singularis*, a troglomorphic species from Fly Cave in Fremont County, Colorado, is described. This is the first cavernicolous pseudoscorpion to be reported from the state. It is compared with *M. montanus*, the local epigeal species, for which an emended description is given.

Keywords: Pseudoscorpiones, Chthoniidae, *Mundochthonius*, cavernicole, Colorado

The genus *Mundochthonius* Chamberlin 1929 is Holarctic in distribution, with two species known from subtropical areas, in Mexico and Hispaniola (see references in Harvey 1991). Its member species are mostly very small, litter-dwelling creatures; and some have been found in caves. In the United States eight species have been described, two of which are cavernicolous, namely, *Mundochthonius cavernicola* Muchmore 1968 from Illinois and *M. holsingeri* Benedict & Malcolm 1974 from Virginia. Recently, another cavernicolous species has been discovered in Colorado, this one more highly troglomorphic than the other two; it is described below. But first, I take this opportunity to redescribe *Mundochthonius montanus* Chamberlin 1929, the surface-dwelling species in the area, for comparison with the new cave-dwelling form.

The specimens studied here have been dissected, cleared, and mounted in Canada balsam on microscope slides. They are in the following depositories: California Academy of Sciences, San Francisco, California (CAS); Florida State Collection of Arthropods, Gainesville, Florida (FSCA). Some abbreviations are used in the descriptions: L = length; L/B = ratio, length/breadth; L/D = ratio, length/depth; m = microseta; T = tactile seta.

Genus *Mundochthonius* Chamberlin

Mundochthonius Chamberlin 1929: 64; Beier 1932: 36; Hoff 1949: 436; Hoff 1956: 10; Morikawa

1960: 94; Beier 1963: 18; Muchmore 1973: 48; Benedict 1978: 250; Harvey 1991: 190.

Though not reported here in detail, the holotype male of *Mundochthonius erosidens* Chamberlin 1929, type species of *Mundochthonius*, has been examined and found to support the following diagnosis.

Diagnosis.—*Mundochthonius* is easily diagnosed. It shares the following characters with several other chthoniid genera, namely, *Austrochthonius* Chamberlin 1929, *Congochthonius* Beier 1959, *Francochthonius* Vitalidi Castri 1976, *Malcolmochthonius* Benedict 1978, and *Mexichthonius* Muchmore 1975: 1) coxal spines present only on coxae II; 2) contiguous teeth on fingers of palpal chela; 3) trichobothrium *sb* (usually much) closer to *st* than to *b* on movable chelal finger; 4) epistome prominent, serrate; 5) one or more microsetae on anteromedial process (apex) of coxa I. However, it may be distinguished from all of these by the possession of a bisetose intercoxal tubercle between the bases of coxae III and IV.

Remarks.—Though not mentioned by Chamberlin (1929), the holotype of *Mundochthonius erosidens* has a small, but distinct, heavily serrate, triangular epistome at the middle of the anterior margin of the carapace. All other species in the genus appear to have a similar, but usually larger, epistome.

American species of *Mundochthonius* (including *M. erosidens*) appear to have only two weak eyes or none at all. On the other hand,

one species in Europe, *M. alpinus* Beier 1947 (and 1963), is described as having four eyes, though other species in Europe and Asia are reported to have only two eyes or none (see references in Harvey 1991).

Contrary to the statement of Chamberlin in his "Analytical Key to the Genera of the Kewochthonini" (1929: 63), all American species of *Mundochthonius* that I have examined (including *M. erosidens*) possess 1–3 microsetae on the anteromedial process (apex) of coxa I. Species from elsewhere are also reported to possess these small setae.

The coxal spines of the American species of *Mundochthonius* that I have examined appear as flattened blades, variously indented or incised at the distal ends and along the sides, as described and figured by Chamberlin (1929, 1931), by Hoff (1949, 1952), and by Muchmore (1973). None looks like the cone-shaped, setaceous or spiny structures described and illustrated for *M. alpinus* Beier (1947, 1963), and for *M. decouii* Dumitresco & Orghidan (1970), or those of *M. carpaticus* Rafalski (1948); nor do they appear as thick and lobe-like as those of *M. basarukini* Schawaller (1989). Because of the minute size of the coxal spines in most species of *Mundochthonius*, satisfactory descriptions of their structure will probably be achieved only by following Schawaller (1989) in the use of scanning electron microscopy. In any event, the "coxal spines" of the new species, *M. singularis*, are unique in being very deeply dissected and elongated to resemble, somewhat, the antlers of a deer.

Mundochthonius montanus Chamberlin
Figs. 1, 2, 8

Mundochthonius montanus Chamberlin 1929: 65; Chamberlin 1931: fig. 21I; Hoff 1952: 40, figs. 1–4; Hoff 1956: 10; Hoff 1959: 26, 33, etc.; Hoff 1961: 420; Harvey 1991: 191.

Type data.—Holotype female (JC-86.01001) from "Manitou [El Paso County] - Colorado. Elev. 8500. In - soil (surface). Coll. E.W. Goldsmith." (mounted on microscope slide by J.C. Chamberlin; in CAS, Type No. 17445).

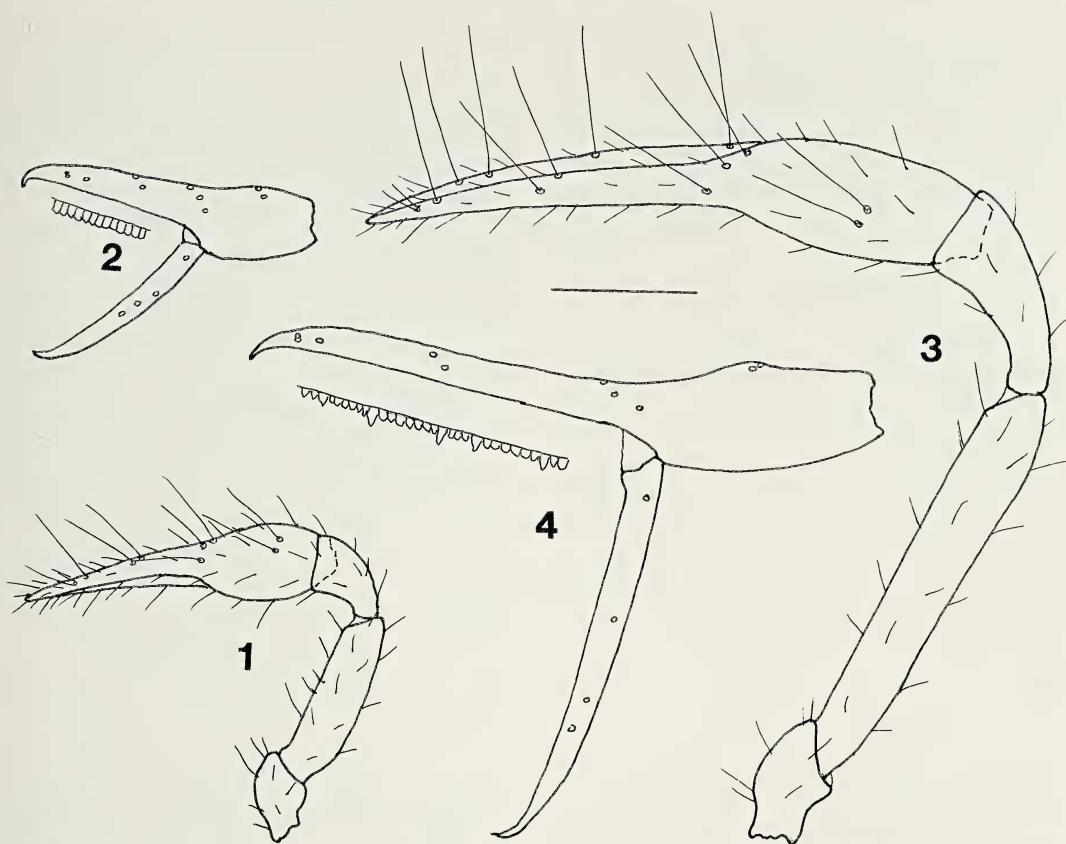
The original description by Chamberlin (1929) was very brief. Hoff (1952, 1956, 1961) added some observations and measurements based on specimens from New Mexico and Colorado, but he did not record several

important details. It seems wise to redescribe the holotype in relation to Hoff's material, in order to firmly establish the species. The holotype has been dissected, the body stained pink, and mounted in Canada balsam; the right palp is missing and the left palpal segments have been somewhat compressed and broken by the cover; many vestitural setae are too faint to see clearly.

Redescription of holotype female.—Representative of the genus as outlined above and with the following particular features. Carapace a little longer than broad; epistome small, triangular, serrate; two very small eyes; chaetotaxy 6-4-4-2-2. Coxal area typical, but no microsetae observable on apex of coxa I; coxal spines as shown by Chamberlin (1931: fig. 21I); bisetose intercoxal tubercle present. Tergal chaetotaxy 4:4:6:6:6:6:-(others not observable). Sternal chaetotaxy 10:(3)8(3):-(others not observable). Chelicera about 0.85 as long as carapace; flagellum of nine setae; spinneret a small knob on finger margin; setae on hand not observable, but Chamberlin reported six (1929: 64). Palp rather robust (see Fig. 1). Because of damage, the palpal segments are not measurable with accuracy; Chamberlin reported L/B of femur and chela as 4 and 3.8, respectively. Measurements and ratios for some other Colorado specimens are given below. Trichobothriotaxy typical (see Fig. 2). Chelal fingers with numerous but not countable, small, contiguous teeth. Leg IV rather robust (see Fig. 8): L/D of femur+patella 2.45, tibia 3.15.

Measurements (mm).—(These given are deemed reliable in spite of some distortion of the body parts). Body L 1.00. Carapace L 0.33. Chelicera L 0.295. Palp: femur 0.31/?; patella 0.155/?; chela 0.495/?; hand 0.185/?; movable finger L 0.34. Leg IV: femur+patella 0.26/0.115; tibia 0.19/0.06.

Variation.—As discussed by Hoff (1961), there is considerable variation among the specimens assigned to *Mundochthonius montanus*. According to the values given by Hoff (1952, 1961), the measurements for *M. montanus* in New Mexico and Colorado range as follows (females average slightly larger than males): Body L 0.92–1.25. Carapace L 0.32–0.40. Palpal femur 0.263–0.350/0.068–0.094; patella (New Mexico only) 0.155–0.186/0.086–0.105; chela 0.420–0.545/0.100–0.127; hand 0.155–0.211/0.100–0.126; movable fin-



Figures 1–4.—Species of *Mundochthonius*, palps. Figs. 1, 2. *Mundochthonius montanus* Chamberlin, female from Colorado. 1. Right palp, dorsal view; 2. Left chela, lateral view, setae omitted, with teeth from fixed finger. Figs. 3, 4. *Mundochthonius singularis* new species, holotype female. 3. Right palp, dorsal view; 4. Left chela, lateral view, setae omitted, with teeth from fixed finger. Scale = 0.25 mm.

ger L 0.270–0.355. Ratios of palpal segments: L/B of femur 3.3–3.9, patella 1.65–1.85, and chela 3.85–4.5; L/D of hand 1.4–1.65; movable finger 1.7–1.85 \times as long as hand. All the reliable measurements and ratios of the holotype fall well within these ranges.

No microsetae (m) are visible on antero-medial process of coxa I of the holotype, probably because of long exposure to clearing agent. However, two or three such setae do appear on coxa I of all other specimens of *M. montanus* I have examined from Colorado and New Mexico.

The coxal spines are quite varied in shape, from a single broad, incised blade, as figured by Chamberlin for the holotype (1931: fig. 21I), to two or three separate, narrower, incised or dentate blades (Hoff 1952: figs. 1–4; 1961: 421).

There are about 50 marginal teeth on each finger of the palpal chela. They are contiguous

basally, uniform in height, and slightly retrodentate or rounded (Fig. 2).

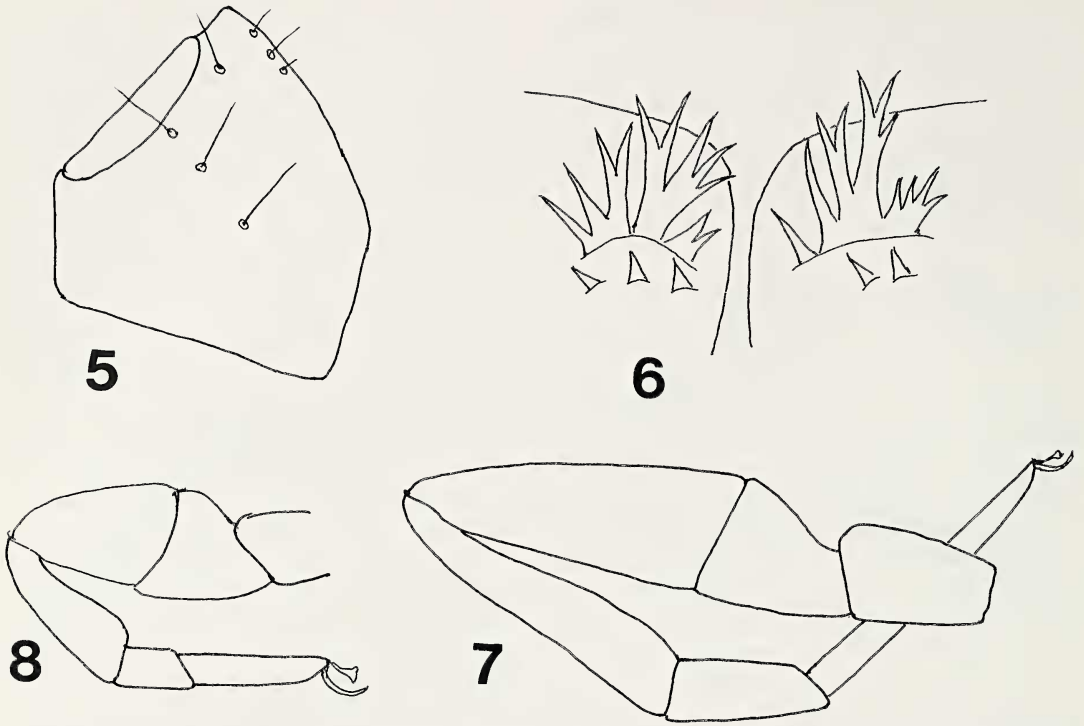
Remarks.—*Mundochthonius montanus* is a generalized, epigeal species, apparently common in the Rocky Mountains of Colorado and New Mexico. According to Hoff (1959, 1961), it is adapted to life in a wide variety of litter and decomposing wood of logs and stumps, at elevations of 6900–11,000 feet (2100–3350 m). Presumably, it represents the population from which the specialized, cavernicolous *M. singularis* was derived.

Mundochthonius singularis new species

Figs. 3–7

Type data.—Holotype female (WM8097. 01001) from under a rock, about 30 m inside Fly Cave, 20 km N of Canon City, Fremont County, Colorado (see Parris 1973: 89–90), 7 August 1996, P. Beron (slide, in FSCA).

Diagnosis.—Differs from other species of



Figures 5–8.—Species of *Mundochthonius*, various features. Figures 5–7. *Mundochthonius singularis* new species, holotype female. 5. Right coxa I (ventral view), showing microsetae on apex; 6. Coxal spines on coxae II (ventral view); 7. Leg IV, setae omitted. 8. *Mundochthonius montanus* Chamberlin, female from Colorado: Leg IV, setae omitted.

the genus in its troglomorphic adaptations: large size (palpal chela 1.07 mm long), attenuated appendages (L/B of palpal chela = 5.8), and an unique arrangement of coxal spines; also, the palpal chelae are heterodentate, rather than homodentate as seen in other species of the genus.

Description.—With the characters of the genus as outlined above, and the following particular features. Chelicerae and palps light brown, carapace tan, other parts lighter. Carapace about as long as broad, narrowed posteriorly; epistome large, irregularly serrate; no eyes; chaetotaxy 6-4-4-2-2. Coxal area generally typical; chaetotaxy 2-2-1:2or3m-2-2(1):2-4(3)-CS:2-5(4):2-3; each coxa I with 2–3 microsetae (m) on medial edge of apex (Fig. 5); each coxa II with an unusual complex of coxal spines (CS), consisting of several differently shaped elements, one on each side somewhat resembling an antler of a deer (Fig. 6); a bisetose intercoxal tubercle present. Tergal chaetotaxy 4:4:4:6:6:6:6:6:6:6:1T2T1:0; sternal chaetotaxy 10:(4)6(4):(2)6(2):11:10:9:

10:8:7:0:2. Chelicera 0.85 as long as carapace; hand with 6 setae; flagellum of 10 setae; galea a very small elevation; each finger with 10–15 small teeth. Palp long and slender (Fig. 3); femur 1.45× and chela 2.05× as long as carapace. L/B of trochanter 1.75, femur 6.25, patella 2.35, and chela 5.8; L/D of hand 2.1; movable finger 1.8× as long as hand. Surfaces smooth. Trichobothria as shown in Fig. 4. Fixed finger with about 95 and movable finger with about 85 contiguous, cusped teeth; on each finger, about 12 teeth are conspicuously larger and sharper than adjacent ones (Fig. 4). Legs long and slender: leg I with femur 2.05× as long as patella; leg IV (Fig. 7) with L/D of femur+patella 3.8 and tibia 4.8.

Measurements (mm).—Holotype female (male unknown). Body L 1.59. Carapace L 0.52. Chelicera L 0.45. Palp: trochanter 0.22/0.125; femur 0.75/0.12; patella 0.355/0.15; chela 1.07/0.185; hand 0.385/0.185; movable finger L 0.69. Leg I: femur 0.38/0.06; patella 0.185/0.06. Leg IV: femur+patella 0.53/0.14;

tibia 0.385/0.08; basitarsus 0.18/0.06; telotarsus 0.355/0.045.

Etymology.—The species is called *singularis* (Latin, *different*) for its unusual characters, especially the coxal spines, compared with other members of the genus.

Remarks.—*Mundochthonius singularis* is the first cavernicolous pseudoscorpion recorded from Colorado. It is certainly troglotic, being much more highly modified for cave life than any other known species of the genus. It is the largest known species of *Mundochthonius*, with lengths of palpal femur and chela 0.75 and 1.07 mm respectively, compared to the cavernicolous *M. cavernicola* (0.57 and 0.92 mm) and the epigeal *M. montanus* (0.26–0.35 and 0.44–0.54 mm); and it has very slender appendages, with L/B of palpal femur and chela 6.25 and 5.8, compared to *M. cavernicola* (4.4 and 4.65) and *M. montanus* (3.5–4.0 and 3.8–4.35). Correlated with the elongated chela, trichobothrium *sb* on the movable finger is much farther removed from *st* than it is in other species of the genus; but it is still closer to *st* than to *b*.

The coxal spines are uniquely deeply incised and enlarged, apparently an adaptation to some aspect of life in a cave. The coxal spines of the other known cavernicolous species, *M. cavernicola* and *M. holsingeri*, are not so modified. The function of the coxal spines of chthonioid pseudoscorpions is not known with certainty, but Chamberlin (1931: 93) considered it “most probable that they are sensory, perhaps tactile.” Alternatively, Judson (1990) reported observations of the coxal spines of three species of chthonioids from West Africa being used in cleaning the legs. Whether one or both of these functions is operative in *Mundochthonius* is still unknown.

In *Mundochthonius montanus* and other species in the genus, the palpal chelae may be characterized as “homodentate”—adjacent teeth of the marginal rows are very much alike, and any differences in size and shape tend to be gradual along the row. In *M. singularis*, however, there are frequent teeth which are distinctly broader and taller than adjacent teeth. It may be supposed that this unusual dentition is correlated with a diet in the cave different from that of the other species.

Fly Cave is named for the many flies encountered just inside the entrance (Pollard 1954; Parris 1973). According to Ayre

(1961a, b), the flies are *Neomuscina tripunctata* (Van der Welp), “a breed common in Mexico and rang[ing] into this portion of the state of Colorado.” Also, Fly Cave is the type locality of the unusual spider *Hypochilus bonneti* Gertsch 1964 (and see Vogel & Ayre 1961). Neither the fly nor the spider is troglitic.

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